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13. ABSTRACT *(Maximum 200 words)*

This research focuses on applying mixed-integer programming (MIP) to selected problems of the U.S. Army. Many strategic planning problems can be formulated as MIPs but frequently they contain a huge number of variables and/or constraints that make the models intractable for currently available MIP solvers. This research has two distinct aspects.

*Developing and implementing new methodology for solving large-scale MIPs.
*Working with the Concepts Analysis Agency on the solution of specific large-scale MIPs and on technology transfer.

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FINAL REPORT

Applications of Mixed-Integer Programming to Problems of the U.S. Army

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1 Problem Studied

This research focuses on applying mixed-integer programming (MIP) to selected problems of the U.S. Army. The research has two distinct aspects.

1. Developing and implementing new methodology for solving general MIPs.
2. Working with the Concepts Analysis Agency on the solution of specific large-scale MIPs and on technology transfer.

2 Summary of Results

We have substantially improved the capability of our mixed integer system (MINTO) to solve large-scale complex problems. There have been advances in primal heuristics for set partitioning problems and new developments in getting stronger mixed-integer cuts. The stronger mixed integer cuts allow us to solve some benchmarking problems from the MIPLIB (mixed-integer library) that cannot be solved by state-of-the-art commercial software. We have shown that a subproblem associated with finding strong cuts for binary integer programs is NP-Hard. We have applied this methodology to solve a problem of base closing for the U.S. Army in Germany.

3 Publications and Technical Reports

A. Atamturk, G.L. Nemhauser and M.W.P. Savelsbergh, "A Combined Lagrangian, Linear Programming, and Implication Heuristic for Large-Scale Set Partitioning Problems," Journal of Heuristics. 1, 2 47-259, 1995.

Z. Gu, G.L. Nemhauser and M.W.P. Savelsbergh, "Lifted Cover Inequalities for 0-1 Integer Programs: Computation," LEC-94-09, School of Industrial and Systems Engineering, Georgia Institute of Technology, revision with INFORMS Journal on Computing.

Z. Gu, G.L. Nemhauser and M.W.P. Savelsbergh, "Lifted Cover Inequalities for 0-1 Integer Programs: Complexity," to appear in INFORMS Journal on Computing.

Z. Gu, G.L. Nemhauser and M.W.P. Savelsbergh, "Sequence Independent Lifting," LEC-95-08, School of Industrial and Systems Engineering, Georgia Institute of Technology, submitted to Mathematics of Operations Research.

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D. Klabjan and G.L. Nemhauser, "Cover Inequality Separation is NP-Hard," to appear in Operations Research Letters.

A. Loerch, N. Boland, E.L. Johnson and G.L. Nemhauser, "Finding an Optimal Stationing Policy for the US Army in Europe After the Force Drawdown," LEC-94-11, School of Industrial and Systems Engineering, Georgia Institute of Technology, revision with Military Operations Research.

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